

**ETHYLENE CHAIN GROWTH IN CATALYTIC DEHYDRATION
OF BIO-ETHANOL USING VARIOUS GROUPS OF METAL CATALYSTS**

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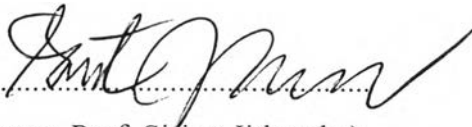
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ABSTRACT

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Metal catalysts that have been widely used to produce aliphatic long-chain hydrocarbons were selected based on two groups of reactions; that are Fischer-Tropsch synthesis (FT) and Olefin polymerization (OPR) for the catalytic dehydration of bio-ethanol. Moreover, $\gamma\text{-Al}_2\text{O}_3$ has been found as the simple, but suitable support for ethylene production in ethanol dehydration because of its acidity and physical property. Therefore, the effect of metal-promoted catalysts were examined in the catalytic dehydration of bioethanol, aiming to investigate the possibility of ethylene oligomerization and chain growth from the product. The change of oxidation state of metals was also investigated for its effect on bio-ethanol dehydration products. As a result, all metal-promoted catalysts tended to have possibility to promote ethylene oligomerization, but they had different ability. Fischer-Tropsch-type catalysts; that are, Co and Fe catalysts, promoted similar pathways of ethylene chain growth through ethylene aromatization. Consequently, the hydrocarbon products were all aromatics. On the other hand, the growth of ethylene by using olefin polymerization-type catalysts can be divided into two different pathways. Ni, Cu, and Pd catalysts tend to promote ethylene chain growth via cyclization and dehydrogenation. However, Cr catalysts seem to promote the growth of ethylene through oligomerization, cyclization, and dehydrogenation. In addition, the hydrocarbons obtained from using FT-type catalysts were all aromatics. However, the hydrocarbons obtained from using the OPR-type catalysts were composed of non-aromatics and aromatics.

บทคัดย่อ

บัณฑิต โชคเจริญชัย : การศึกษาการเชื่อมต่อกันของโมเลกุลเอทิลีนในปฏิกิริยาดีไฮเดรชันของเอทานอลชีวภาพ โดยใช้ตัวเร่งปฏิกิริยาจากโลหะหลายกลุ่ม (Ethylene Chain Growth in Catalytic Dehydration of Bio-ethanol Using Various Groups of Metal Catalysts)
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ตัวเร่งปฏิกิริยาโลหะที่นำมาใช้กันอย่างแพร่หลายในการผลิตสารประกอบไฮโดรคาร์บอนเส้นตรงและเป็นสายยาวนั้น ได้ถูกเลือกมาจากสองกลุ่มปฏิกริยานั้นคือ กระจบวนฟิชเชอร์โทรป และ โอลิฟินพอลิเมอร์ไรเซชัน เพื่อใช้ในกระบวนการดีไฮเดรชันของเอทานอลในงานวิจัยนั้นนอกจากนี้แกรวม่าอะลูมิน่าเป็นตัวรองรับอย่างง่ายที่มีความเหมาะสมที่จะใช้ในการผลิตเอทิลีนจากปฏิกิริยาดีไฮเดรชันของเอทานอลชีวภาพ เพราะมีสมบัติความเป็นกรดและลักษณะทางกายภาพที่เหมาะสม ดังนั้นในงานวิจัยนี้เป็นการศึกษาผลของตัวเร่งปฏิกิริยาโลหะในรูปแบบของโลหะและโลหะออกไซด์ในปฏิกิริยาดีไฮเดรชันของเอทานอลชีวภาพ โดยมีจุดประสงค์เพื่อที่จะศึกษาความเป็นไปได้ของการเกิดเอทิลีน โอลิโกเมโรไรเซชันและการเชื่อมต่อกันของโมเลกุลเอทิลีนในผลิตภัณฑ์ไฮโดรคาร์บอน จากผลการศึกษาพบว่าตัวเร่งปฏิกิริยาบนตัวรองรับทุกชนิดนั้นมีความสามารถในการกระตุ้นปฏิกิริยาเอทิลีน โอลิโกเมโรไรเซชันได้ แต่ความสามารถในการกระตุ้นนั้นไม่เท่ากัน ตัวเร่งปฏิกิริยาโคบอลและไอรอนในกลุ่มฟิชเชอร์โทรปทั้งในรูปของโลหะและโลหะออกไซด์นั้น โดยพบว่าตัวเร่งปฏิกิริยาจากกลุ่มฟิชเชอร์โทรปที่ประกอบไปด้วยโคบอลและไอรอนจะให้เส้นทางในการต่อกันของเอทิลีนที่เหมือนกัน คือผ่านปฏิกิริยาเอทิลีนอะโรมาไทเซชัน ผลิตภัณฑ์ที่ได้นั้นจะเป็นสารอะโรมาติกส์ทั้งหมด ในทางตรงกันข้าม การเชื่อมต่อกันของเอทิลีนที่ใช้ตัวเร่งปฏิกิริยาจากกลุ่มโอลิฟินพอลิเมอร์ไรเซชันนั้นสามารถแบ่งออกได้เป็นสองเส้นทางที่แตกต่างกัน กล่าวคือ ตัวเร่งปฏิกิริยาโลหะและโลหะออกไซด์ของทั้งนิกเกิล ทองแดง และ พาเลเดียมนั้น ให้เส้นทางในการต่อกันของเอทิลีนที่คล้ายกัน คือผ่านปฏิกิริยาไซโคลเซชันและดีไฮโดรจีเนชัน แต่ตัวเร่งปฏิกิริยาโครเมียมนั้น จะให้เส้นทางที่แตกต่างกันออกไป โดยการเชื่อมต่อกันของเอทิลีนนั้นผ่านปฏิกิริยาโอลิโกเมโรไรเซชัน ไซโคลเซชัน และดีไฮโดรจีเนชัน นอกจากนี้การเชื่อมต่อกันของโมเลกุลเอทิลีนนั้นยังสามารถจำแนกออกได้เป็นสองเส้นทาง คือตัวเร่งปฏิกิริยาในกลุ่มฟิชเชอร์โทรปนั้นจะให้ผลิตภัณฑ์ที่เป็นสารอะโรมาติกส์ทั้งหมด อย่างไรก็ตาม ตัวเร่งปฏิกิริยาในกลุ่มโอลิฟินพอลิเมอร์ไรเซชันจะให้ผลิตภัณฑ์ที่ประกอบไปด้วยสารอะโรมาติกส์และไม่ใช่อะโรมาติกส์

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